Present and Future Chinese Meteorological Satellite Mission for Atmospheric Remote Sensing

Peng Zhang
National Satellite Meteorological Center (NSMC/CMA)

Email: zhangp@nsmc.cma.gov.cn
Tel: 86-10-68409671
Main Topics

1. Main Tasks of NSMC
2. Current Status of Chinese Meteorological Satellite System
3. The Meteorological Satellite Data Services in China
5. Plan for Future Chinese Meteorological Missions
1. Main Tasks of NSMC

- To be responsible for receiving, processing, distributing and application of meteorological satellite data.
- To study and draft strategy and development program for China’s meteorological satellites.
- To build up ground segment for China’s meteorological satellites.
- To fulfill scientific researches on meteorological satellite and satellite meteorology.
- To monitor and forecast space weather (New)
space weather services

Sea level

500km

15-50km

0-15km
China Meteorological Administration

- One organization, two names
- NCSW was founded in 2002, which acts as the national center authorized by the State Council, to carry out the space weather operation and provide space weather services.
NCSW’s daily Operation

- Data acquisition and collection
- Space weather analysis and forecast
- Space weather events evaluation
- Public service

www.spaceweather.gov.cn
Spwx monitor and analytic system

FY-1 Spatial Particle Monitor and Display

FY-2 Spatial Particles Monitor and display
Observations at present

<table>
<thead>
<tr>
<th>Space-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY-1C/D meteorological satellites</td>
</tr>
<tr>
<td>high energy particle et al.,</td>
</tr>
<tr>
<td>FY-2B/2C meteorological satellites</td>
</tr>
<tr>
<td>high energy particle et al., and solar X-ray flux.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ground-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS network in CMA</td>
</tr>
<tr>
<td>……</td>
</tr>
</tbody>
</table>
Observations in the future

- Space environment sensor suite (SESS) on board FY-3 operational satellites
- Solar X-ray Imager (SXI) on board FY-4
- KuaFu!
- Country-wide ground-based observations
Outing of KuaFu project

KuaFu-A, on the L1 Point

KuaFu B1 and B2, on the Polar Orbit
2. Current Status of Chinese Meteorological Satellite System

NSMC maintains an operational system which consists of two operational systems.

- Polar-orbit satellites operational system obtain both local and global environment data;
- Geostationary satellites system provide observation of East-Asia hemisphere hourly.
FY-1 Series------ China's 1st Generation of Polar Orbit Meteorological Satellites
FY-1A, FY-1B with 5 Channel Visible and Infrared Radiometers
FY-1C, FY-1D with 10 Channel Visible and Infrared Radiometers

FY-2 Series------ China's 1st Generation of Geostationary Meteorological Satellites
FY-2 A&B with 3-channel VI SR
FY-2 C&D with the 5-channel VI SR
Chronology of the FY-1 Program

- FY-1A was launched on Sept. 7, 1988
- FY-1B was launched on Sept. 3, 1990
- FY-1C was launched on May 10, 1999
- FY-1D was launched on May 15, 2002
《风云一号》第一幅展宽云图

The First Stretched Cloud Image of FY-1C 1999.5.10. 03:17(UTC) / 11:17(北京时间)

天山
Tian Shan

塔里木盆地
Tarim Basin

青藏高原
Tibetan Plateau

中国气象局国家卫星气象中心 NSMC/CMA
Global Multi-Orbit Mosaic Image
Composite Imagery of Antarctic region by FY-1C GDPT Channel 1,2,3.
The First Delayed Picture Transmission (DPT) of FY-1C

1999.5.10.06:41(UTC)/14:41(北京时)

Europe

The Mediterranean Sea
Chronology of the FY-2 Program

- FY-2A was launched on June 10, 1997
- FY-2B was launched on June 25, 2000
- FY-2C was launched on Oct. 18, 2004
- FY-2D to be launched in 2006
Chinese FY Series Satellites

<table>
<thead>
<tr>
<th>Since 1969</th>
<th>Concept Design</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1988.9.7</td>
<td>FY1-A</td>
<td>R&amp;D (5)</td>
</tr>
<tr>
<td>1990.9.3</td>
<td>FY1-B</td>
<td>R&amp;D (5)</td>
</tr>
<tr>
<td>1997.6.10</td>
<td>FY2-A</td>
<td>R&amp;D (3)</td>
</tr>
<tr>
<td>1999.5.10</td>
<td>FY1-C</td>
<td>Operation (10)</td>
</tr>
<tr>
<td>2000.6.25</td>
<td>FY2-B</td>
<td>R&amp;D (3)</td>
</tr>
<tr>
<td>2002.5.15</td>
<td>FY1-D</td>
<td>Operation (10)</td>
</tr>
<tr>
<td>2004.10.19</td>
<td>FY2-C</td>
<td>Operation (5)</td>
</tr>
</tbody>
</table>

➢ 7 satellites launched
FY-1D and FY-2C are in operation

FY-1D:
• launched on May 15, 2002,
• over design life and still health in operation

FY-2C
• launched on Oct. 19, 2004
• located at 105ºE
• good operation now
Important Composition of GCOS by WMO
3. The Meteorological Satellite Data Services in China (Acquisition, Archive and Dissemination)
Daily Operational Services in Data Processing Center (DPC)

Meteorological Satellite Data Receiving and Pre-Processing System

Data Processing System

Data Archive system

Typhoon

Dust & Fog

Precipitation

Drought & Vegetation

Fire & Flood

Snow & Sea Ice

Other land Surface Monitoring

Product Dissemination system (Web, VSAT, internet, hard copy etc)

Central Meteorological Office

Local Weather Office

Management Department

The State Council

Forestry Ministry

Ministry of Water Resources

Agricultural Ministry and other related government departments

Users: The State Council, Ministry of Agriculture, National Forestry Administration, National Remote Sensing Center, Local Provincial Meteorological Office, etc.
Data acquisition: ground station
Data archive: History data over 20 years

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Data Format</th>
<th>Content/Orbit</th>
<th>Period</th>
<th>Media</th>
<th>Total Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY-1C/1D</td>
<td>CHRPT</td>
<td>200MB</td>
<td>99.05-now</td>
<td>Tape</td>
<td>8 TB</td>
</tr>
<tr>
<td></td>
<td>GDPT</td>
<td>300MB</td>
<td>99.05-now</td>
<td>Tape</td>
<td>10 TB</td>
</tr>
<tr>
<td>EOS-AM/PM</td>
<td>MODIS</td>
<td>1GB</td>
<td>00.12-now</td>
<td>CD</td>
<td>60 TB</td>
</tr>
<tr>
<td>NOAA(7-18)</td>
<td>HRPT</td>
<td>120MB</td>
<td>84.05-now</td>
<td>Tape</td>
<td>20 TB</td>
</tr>
<tr>
<td>GMS-4/5</td>
<td>S-VISSR</td>
<td>100MB</td>
<td>89.01-now</td>
<td>Tape</td>
<td>14 TB</td>
</tr>
<tr>
<td>FY-2A/B/C</td>
<td>S-VISSR</td>
<td>100MB</td>
<td>97.09-now</td>
<td>Tape</td>
<td>10 TB</td>
</tr>
<tr>
<td>METEOSAT-5</td>
<td>HRI</td>
<td>40MB</td>
<td>99.06-now</td>
<td>CD</td>
<td>1.5 TB</td>
</tr>
<tr>
<td>GMS-1/2/3</td>
<td>WEFAK</td>
<td>模拟图像</td>
<td>78.1-88.8</td>
<td>Film</td>
<td>- -</td>
</tr>
<tr>
<td>NOAA(4-7)</td>
<td>APT</td>
<td>模拟图像</td>
<td>72.1-85.6</td>
<td>Film</td>
<td>- -</td>
</tr>
</tbody>
</table>
Data archive: Current on operational

<table>
<thead>
<tr>
<th>No.</th>
<th>Satellite</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Polar</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FY-1D</td>
<td>CHRPT, GDPT</td>
</tr>
<tr>
<td>3</td>
<td>EOS-AQUA/TERRA</td>
<td>MODIS</td>
</tr>
<tr>
<td>3</td>
<td>NOAA-12/16/17/18</td>
<td>HRPT</td>
</tr>
<tr>
<td></td>
<td><strong>Geostationary</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>FY-2C</td>
<td>S-VISSR</td>
</tr>
<tr>
<td>5</td>
<td>MTSAT</td>
<td>HiRiD</td>
</tr>
<tr>
<td>6</td>
<td>Meteosat-5</td>
<td>HRI</td>
</tr>
</tbody>
</table>
## Products from FY2C

<table>
<thead>
<tr>
<th>Name of Product</th>
<th>Coverage</th>
<th>Time/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>50°N-50°S  55°E-155°E</td>
<td>4</td>
</tr>
<tr>
<td>SST</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Upper Troposphere Humidity</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>ISCCP Data set</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Precipitation Index</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Precipitation Estimation</td>
<td>60°N-60°S  45°E-165°E</td>
<td>4</td>
</tr>
<tr>
<td>Cloud Classification</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Cloud Amount</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Humidity Profile from Cloud</td>
<td>50°N-50°S  55°E-155°E</td>
<td>8</td>
</tr>
<tr>
<td>Perceptible Water in Clear Sky Region</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Outgoing Long wave Radiation</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
<tr>
<td>Solar Irradiance</td>
<td>60°N-60°S  45°E-165°E</td>
<td>1</td>
</tr>
<tr>
<td>Snow Cover</td>
<td>60°N-60°S  45°E-165°E</td>
<td>1</td>
</tr>
<tr>
<td>Sea Ice</td>
<td>60°N-60°S  45°E-165°E</td>
<td>1</td>
</tr>
<tr>
<td>Flood Monitoring</td>
<td>China</td>
<td>1</td>
</tr>
<tr>
<td>Soil Moisture</td>
<td>60°N-60°S  45°E-165°E</td>
<td>1</td>
</tr>
<tr>
<td>Fire Monitoring</td>
<td>China</td>
<td>24</td>
</tr>
<tr>
<td>Tropical Cyclone Position and Intensity</td>
<td>Western Pacific and India Ocean</td>
<td>24</td>
</tr>
<tr>
<td>Sand Storm Monitoring</td>
<td>China and Mongolia</td>
<td>8</td>
</tr>
<tr>
<td>Fog</td>
<td>China</td>
<td>24</td>
</tr>
<tr>
<td>TBB</td>
<td>60°N-60°S  45°E-165°E</td>
<td>8</td>
</tr>
</tbody>
</table>
Data Dissemination

- Internet service (SDAC-satellite data achieve center)
  - More than 800 registered users;
  - 20TB/year
- DVB-S Service (110 users stations)
- Satellite Directly Broadcast (400+ MDUS)
- GTS
  - Wind product
  - ATOVS
110 DVB-S reception station

Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Thailand will be users this year.
DVB-S (Ku Band to C band planned)
AsiaSat-4 at 122E
EUMETCast reception
Web Site for Products Dissemination

卫星气象与环境监测

- 台风监测
- 天气监测
- 沙尘监测
- 火情监测
- 水情监测
- 林情监测
- 海情监测

Typhoon

Weather information

- Dust
- Snow

Forest Fire

Flood

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。

国家卫星气象中心利用气象卫星对我国东北、华北、西北等地区的沙尘天气进行监测。
Satellite data and products are being used in the following areas:

(1) Synoptical analysis (天气分析)
(2) Typhoon Guidance (台风指导报)
(3) Dust Storm Monitoring (沙尘暴监测)
(4) Fog Monitoring (雾监测)
(5) Precipitation Estimate (降水估计)
(6) Cloud Classification (云分类)
(7) NWP (数值天气预报)
1) Synoptical analysis

Extratropical Cyclone (温带气旋) Cloud System over North Pacific

Visible and near infrared color composite, 3 April 1999, FY-1C. The cloud spiraling over Kamchatka is a typical occluded cyclone. The frontal system enters the Bering Sea and turns southwestward down to the 30°N proximity to East of Japan. Heavy rain/snow fall along the 2500Km long cloud band. The cold air over the sea surface is warming and gives rise to many vortex and cell clouds at the rear of the frontal system, where boisterous sea and rolling clouds is the usual scene.
Cold Vortex Cloud System over Northwest China

( 冷涡云系 )

( Visible and near infrared color composite)
Mei-yu Front Cloud System (梅雨锋)
(Visible and near infrared color composite)
Long-Longitudinal Cold Front Cloud System
( 冷锋云系 )
( Visible and near infrared color composite)
(2) Typhoon Guidance
北纬 20.9° 东经 127.8°

眼区直径 约 50 km
0604号台风“碧利斯”移动路径
Thermal Structure of Typhoon Pearl by AMSU
(3) Dust Storm Monitoring
The Sources of Sand and Dust Storm
Dust-Storm Properties Retrieval

Optical depth

Particle radius

Dust Concentration
(4) Fog Monitoring
风云一号气象卫星雾区监测图像

风云一号气象卫星雾区示意图

2004年2月19日07～08时（北京时间）
(5) Precipitation Estimate
(6) Cloud Classification
Comparison between Predictions

Right: July 6 12UTC 850 hPa H (analysis)
Below: 45h prediction (radiosondes only)
Right below: 45h prediction (radiosondes + satellite)
Starting from 15UTC July 4. 21, 33, 45 hours forecasts of the center's position are shown.
5. Plan for Future Chinese Meteorological Missions
Chinese Meteorological Satellite: FY Series

Polar System

First Generation

FY
- 1A
- 1B
- 1C
- 1D

Second Generation

FY
- 3A
- 3B
- 3C
- 3H

Geostationary System

First Generation

FY
- 2A
- 2B
- 2C
- 2D
- 2E

Second Generation

FY
- 4
## Schedule of FY Series

<table>
<thead>
<tr>
<th>Mission</th>
<th>88</th>
<th>89</th>
<th>90</th>
<th>91</th>
<th>92</th>
<th>93</th>
<th>94</th>
<th>95</th>
<th>96</th>
<th>97</th>
<th>98</th>
<th>99</th>
<th>00</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>......</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY1</td>
<td></td>
<td>▲A</td>
<td>▲B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▲C</td>
<td>▲D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY2</td>
<td></td>
<td>▲A</td>
<td>▲B</td>
<td>▲C</td>
<td>▲D</td>
<td>▲E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY3</td>
<td></td>
<td>▲A</td>
<td>▲B</td>
<td>▲C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IRAS</td>
<td>(Interferometer)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Mission of FY-3 Series

- **Global sounding capability**
  
  To obtain three-dimensional thermal structure and water vapor distribution of the atmosphere, cloud and other parameters, to support NMC global NWP

- **Global imaging capability**
  
  To monitor severe weather, hydrological and meteorological disasters and biosphere environment, provide information for climate observations

- **Data collection and transmission capability**
FY-3 Ground Segment:

- 7 receiving stations, one of the stations will be in high latitude place (Svabald)
- Data from FY-3 will be broadcasted by DVB-S
• **There are two developing phases for FY-3:**
  - **Exp. Phase (2007-2009 in flight):** 2 satellites with limited sounding capabilities
    - FY-3A Launch scheduled in 2007
    - FY-3B launched scheduled in Early 2009
  - **Operational Phase** (flight after 2009): Satellites Constellation is planned with expanded sounding and imaging capabilities
  - **Low inclination orbit satellite**, mainly for precipitation measurement (mainly Radar, Passive Microwave measurement). Details is still in discussion.
## Payloads onboard on FY-3

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Instrument Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIRR</td>
<td>Visible and InfraRed Radiometer</td>
</tr>
<tr>
<td>IRAS</td>
<td>InfraRed Atmospheric Sounder</td>
</tr>
<tr>
<td>MWTS</td>
<td>MicroWave Temperature Sounder</td>
</tr>
<tr>
<td>MWHS</td>
<td>MicroWave Humidity Sounder</td>
</tr>
<tr>
<td>MERSI</td>
<td>MEedium Resolution Spectral Imager</td>
</tr>
<tr>
<td>SBUS</td>
<td>Solar Backscatter Ultraviolet Sounder</td>
</tr>
<tr>
<td>TOU</td>
<td>Total Ozone Unit</td>
</tr>
<tr>
<td>MWRI</td>
<td>Microwave Radiation Imager</td>
</tr>
<tr>
<td>SIM</td>
<td>Solar Irradiation Monitor</td>
</tr>
<tr>
<td>ERM</td>
<td>Earth Radiation Measurement</td>
</tr>
<tr>
<td>SEM</td>
<td>Space Environment Monitor</td>
</tr>
</tbody>
</table>
Main Instruments on FY-3
(1) Sounding Mission(5 instruments)

• Infrared Atmospheric Sounder (IRAS)
• MicroWave atmospheric Temperature Sounder (MWTS)
• MicroWave atmospheric Humidity Sounder (MWHS, AMSU-B like, onboard FY-3A/B)
• Multichannel Atmospheric Infrared Sounder (MAIRS, OP. phase)
• Solar Backscatter Ultraviolet and Total Ozone Sounder (SBUV/TOS)
Main Instruments on FY-3

(2) Imaging Mission (3 instruments)

- Visible and Infrared Radiometer (VIRR, 10 channels, similar to radiometer aboard FY-1C)
- Medium Resolution Spectral Imager (MERSI)
- MicroWave Radiation Imager (MWRI)
Main Instruments on FY-3

(3) Complementary Mission

- Earth Radiation Budget Unit (ERBU)
- Space Environment Monitor (SEM)
- Data Collection System (DCS)
## Basic Information for Each Instrument

<table>
<thead>
<tr>
<th>Name of Instrument</th>
<th>Number of Channels</th>
<th>Spectral range</th>
<th>Field of Views /line</th>
<th>Spatial Resolution at Sub point (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIRR</td>
<td>10</td>
<td>0.43 – 12.5μm</td>
<td>2048</td>
<td>1.1</td>
</tr>
<tr>
<td>IRAS</td>
<td>26</td>
<td>0.69 – 15.5 μm</td>
<td>56</td>
<td>17</td>
</tr>
<tr>
<td>MWTS</td>
<td>4</td>
<td>50 – 57 GHz</td>
<td>15</td>
<td>50/75</td>
</tr>
<tr>
<td>MWHS</td>
<td>5</td>
<td>150 – 183 GHz</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>MERSI</td>
<td>20</td>
<td>0.41 – 12.5 μm</td>
<td>2048/8192</td>
<td>1.1/250</td>
</tr>
<tr>
<td>SBUS</td>
<td>12</td>
<td>252 – 280 nm</td>
<td>240</td>
<td>70/10</td>
</tr>
<tr>
<td>TOU</td>
<td>6</td>
<td>309 – 361 nm</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>MWRI</td>
<td>6</td>
<td>10.65 – 150 GHz</td>
<td>240</td>
<td>15-70</td>
</tr>
<tr>
<td>ASI</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Satellite Specification

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Major Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Launch Mass</td>
<td>2450Kg</td>
</tr>
<tr>
<td>2</td>
<td>Size</td>
<td><strong>Satellite Size</strong> 4380mm×2000mm×2000mm(X.Y.Z)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Flight Size</strong> 4440mm×10000mm×3790mm(X.Y.Z)</td>
</tr>
<tr>
<td>3</td>
<td>Orbit</td>
<td><strong>Orbit type:</strong> Sun synchronous</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Nominal orbit altitude:</strong> 836.4Km</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Inclination:</strong> 98.753°</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Period:</strong> 101.603min</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Eccentricity:</strong> 0.0025</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Daily flight circles:</strong> 14.1728</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Orbit intercept:</strong> 2827.6Km (Equator)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Time at descending node:</strong> 10:00 ~ 10:20</td>
</tr>
<tr>
<td>4</td>
<td>Instrument</td>
<td>Scan Radiometer, Infrared Spectrometer, Microwave Radiometer ....</td>
</tr>
</tbody>
</table>
Development of FY-3

✓ Phase-I (2004-2008): 2 satellites (FY-3A/ B) with limited sounding capabilities

✓ Phase -II (2008-2016): 5 satellites (FY-3 C/ D/ E/ F/ G) with enhanced sounding and imaging capabilities
Development of FY-3A/B

- FY-3A is planned to be launched in 2007
- Five core instruments (2 for sounding and 3 for imaging mission) onboard FY-3A/B
- In phase-II these instruments will be improved, and some new instruments will be added
- FY-3A/B satellites and instruments are being made
• Future Geostationary Satellites
FY-2 D/E/F/G: launch schedule

FY-2D will be launched in late 2006, two GEO constellation will be formed:

- Wider coverage (possible FY-2C in 123E, and FY-2D in 87.5E, also for contingency)
- More frequent observations during the flooding season for overlap areas (15 minutes)
- New products (ex. Stereo cloud, new wind-height assignment, etc.)
- FY-2E is plan to launch in early 2008 to replace FY-2C
- FY-2F/G will replace FY-2D and FY-2E in 2010 and 2012, respectively
Future Geo-stationary Satellites

Proposal for FY-4
New Generation for Geo: FY-4

Considerations on FY-4:

- Three-Axis Stabilization
- More powerful imager and lightning mapper
- Sounding capability
- More powerful Data Collection Platforms
- Enhanced ground control capability
- Enhanced application and services systems

Now FY-4 is at the Pre-Phase A stage, schedule to be developed during 2006-2012, and launch after 2012
Future Geo-stationary Satellites
- Proposal for FY-4

The proposal for the next generation of Chinese geo-stationary meteorological satellite FY-4 has been put forward. The goal of developing FY-4 is to meet the requirement for meteorological application and to extend the scope of operational meteorological satellite service.
Mission

To provide for the numerical weather forecast and climatic research with precision-improved, better vertical-resolution soundings to enable temperature, humidity, green-house gases to be retrieved.

To make microwave-soundings for parameters in all weather conditions.

To perform the lightning monitoring, to acquire the map of lightning occurrence within the satellite observation coverage.

To broadcast satellite images and data products

To monitor space environment and solar activity
Two Separate Series

FY-4 is proposed to have two separate series
(1) Optics Remote Sensing Series
(2) Microwave Remote Sensing Series.
FY-4 Optics Remote Sensing Series Satellites

The instruments on FY-4 Optics Series include the Multi-channel Scan Imaging Radiometer, the Atmosphere Vertical Sounder, the Lightning Mapping Sensor, and so on. FY-4 Optics Series has 5 satellites to cover 20 years period.

The first two satellites FY-4A and FY-4B are experimental.

The following 3 satellites FY-4C/ D/ E are operational.

The first FY-4 Optics Series Satellite FY-4A is to be launched in 2012.
FY-4 Microwave Series Satellites

Because of the importance of microwave sounding for the meteorology application, and considering the technical difficulty and risk to put microwave radiometer and optical instruments on one satellite, a separate microwave series of FY-4 satellites is suggested.
Satellite Life Time
The satellite is designed to work for 5 years.

Satellite Attitude
3-Axes stabilization

Position
Primary Position: 105E
Position of backup I: 86.5E
Position of backup II: 123.5E
Instrument Payloads on FY-4A/ B

For experimental FY-4 satellites FY-4A/ B, the following instruments are proposed to be the primary payload.

1. Multi-channel Scan Imaging Radiometer
2. Atmosphere Vertical Sounder
3. Lightning Mapper
4. Solar X-Ray Imager
5. Space Environment Monitor
Operational Observation

(1) Multi-channel Scan Imaging Radiometer
   Regional scanning of China area and vicinity 4 times per hour; One earth disc scanning every 1–3 hour,

(2) Atmosphere Vertical Sounder
   One scanning image over China and neighboring areas every half hour; or one earth disc image each hour; detailed scanning once half an hour for medium or small scale weather system on request.

(3) Lightning Mapping Sensor
   Continued lightning observation at 2ms frame time interval when needed. Observation range is adjustable on request.

(4) Solar X-ray Imager and Space Environment Monitor
   To be determined
Fast Scan Mode

Fast scanning for limited area imagery in less than 7.5min, and very fast scanning in less than 1min are on request for monitoring the local severe convective storm or sudden disaster weather.
Information channel and operational function

X band: 7450 ~ 7550MHz

S band HRIT Transponder:
  uplink: 2040 ~ 2070MHz
  downlink: 1670 ~ 1698MHz, 1544.5MHz

USB: uplink: 2025 ~ 2110MHz (telecommand)
  downlink: 2200 ~ 2290MHz (telemetry)

UHF: uplink: 401 ~ 402.1MHz (report)
  406.25 ~ 406.75MHz
Thank you for your attention